

**DISCUSSION OF  
U.S. PATENT APPLICATION  
NO. 09/839,245**

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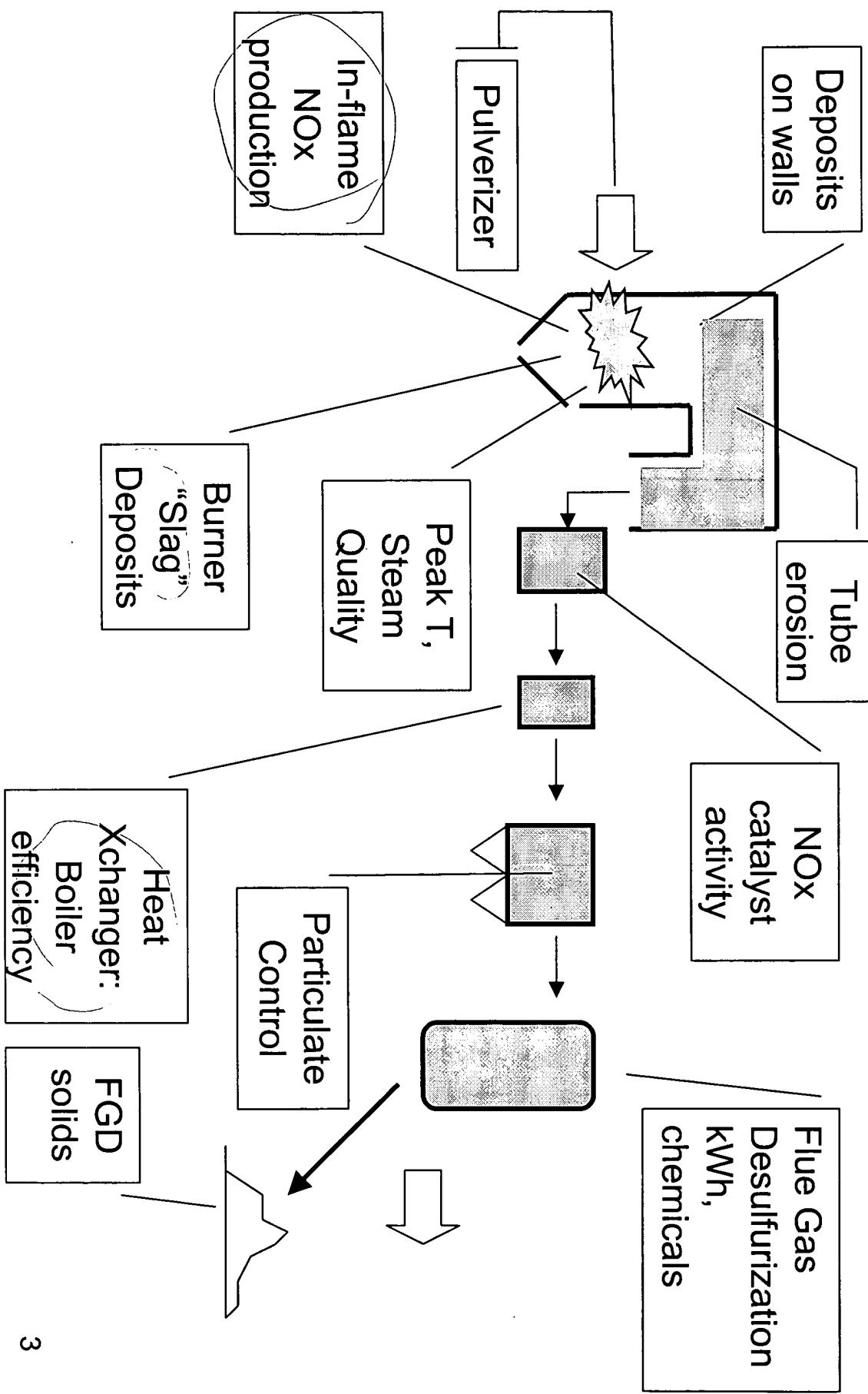
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# FOUR RELEVANT CONCEPTS/FACTS

1. Overview Of Coal-fired Power Generation System
2. Process Performance Model
3. Least Cost Coal Not Always Provides Least Cost Power Production
4. Risk Factors And Uncertainty

# 1. Coal-Fired Generating Plant: Key Factors Affected by Coal Quality



## 2. Process Performance Model

- Engineering Model Of Physics, Chemistry Of Process (Exhibit A)
  - Fluid mechanics
  - Heat transfer
  - Chemistry/chemical kinetics
- Predict Performance, Operating Characteristics
  - Boiler design as important as coal composition
  - specifying coal composition not adequate to define performance

## 2. Examples of Process Model Output

Output: Performance, Operations

- Heat flux through furnace (efficiency)
- inorganic deposits on boiler (derate, availability)
- Auxiliary power: fans, pulverizers

Environmental

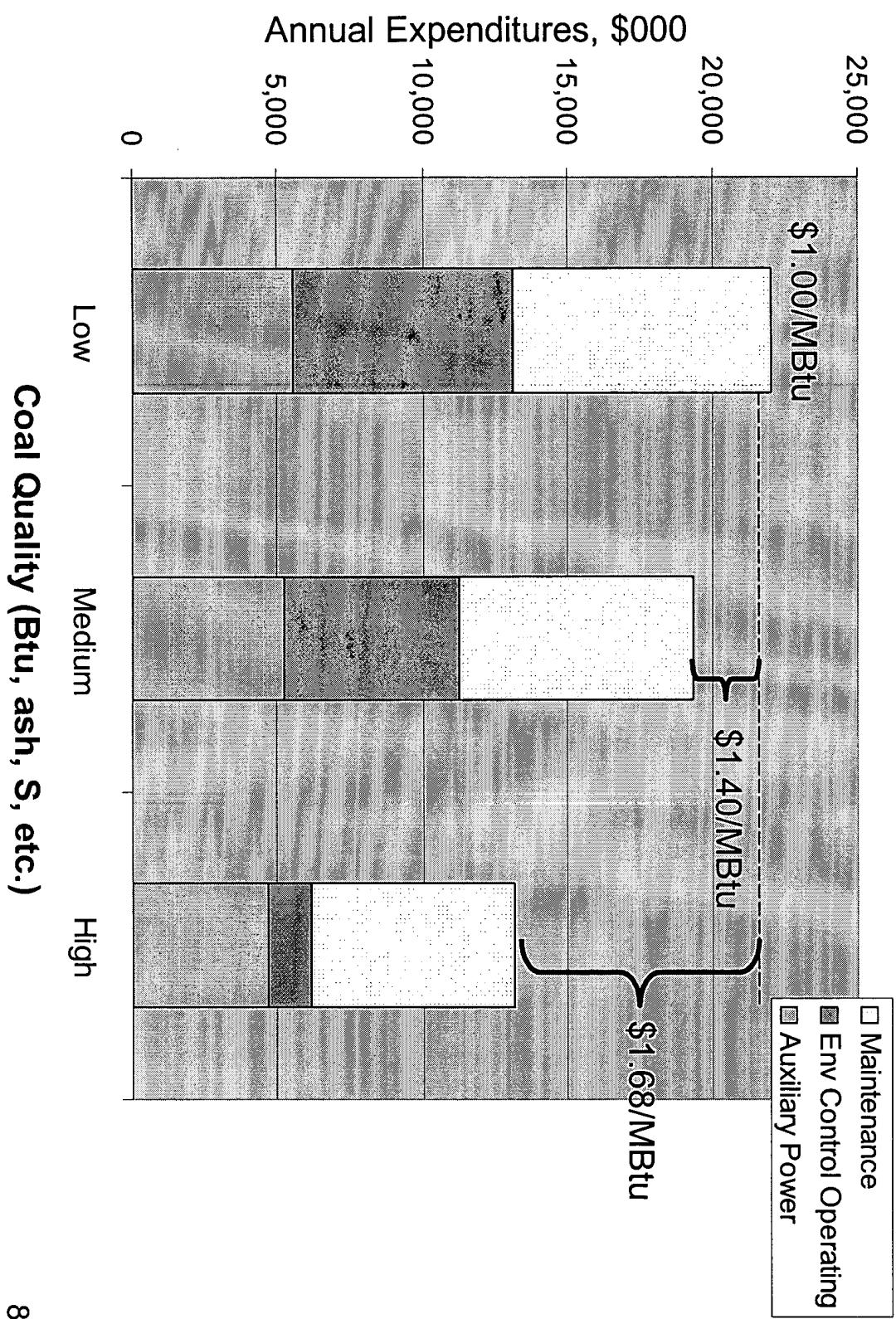
- NOx “catalytic converter”: deactivation, NOx removal
- Flue gas desulfurization: SO<sub>2</sub> removal, byproduct
- Particulate control efficiency (ash electrical properties)
- Hg fate

- Major Symposia on Topic Since 1985
  - Proceedings: Reducing Electricity Generation Costs by Improving Coal Quality (Exhibit B, “Report Summary”)
  - Proceedings: Effects of Coal Quality on Power Plants: Third/Fourth International Conference (Exhibit C)
- Effects of Coal Quality On Power Plant Performance and Costs (Exhibit D, “Report Summary”)

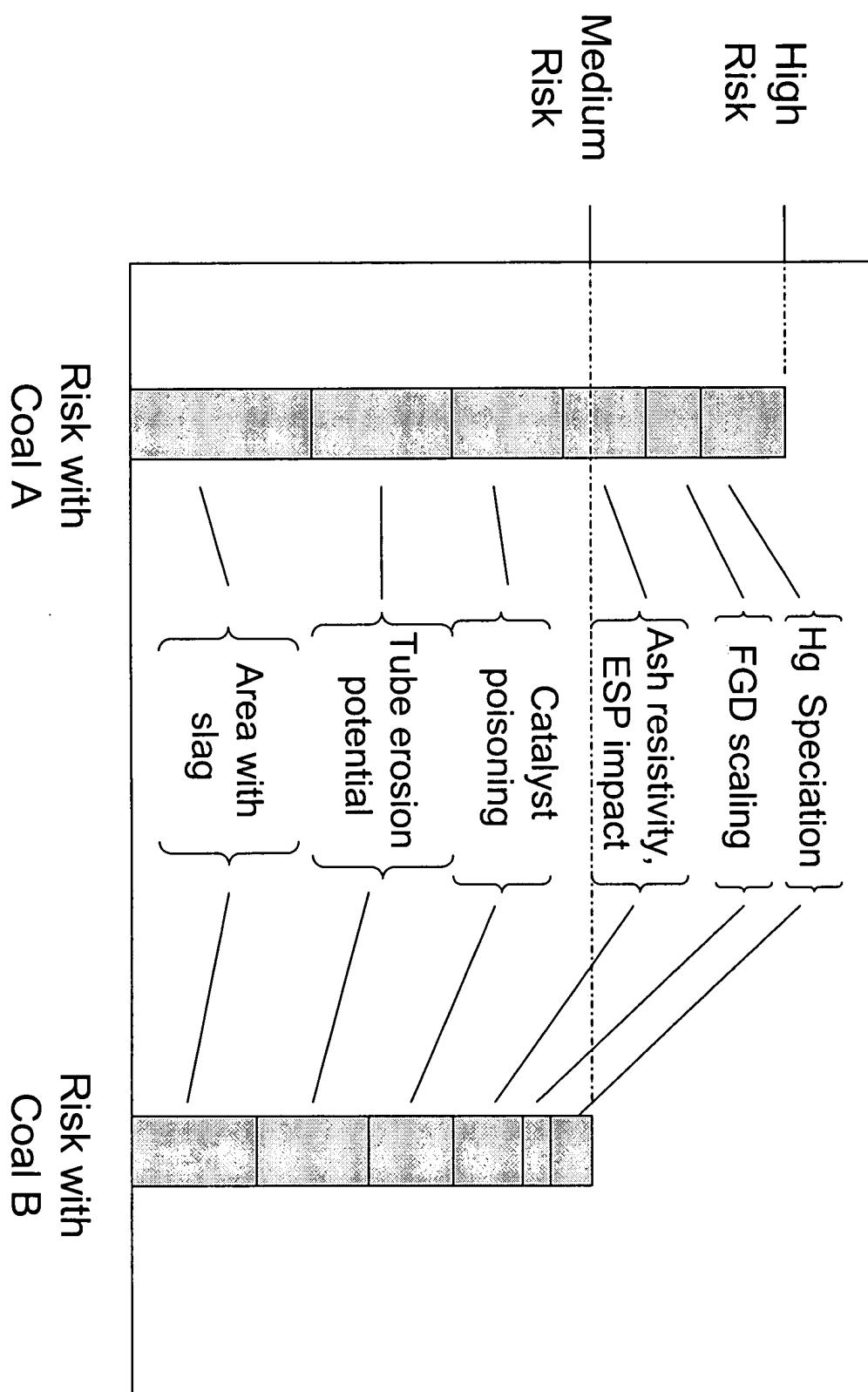
### 3. Example Benefits Of Improving Coal Quality

- Higher Quality, Higher Cost Coal Lowers Electricity Production Cost (from Exhibit B)  
550 MW Plant Non-fuel Expenses
  - auxiliary power (pulverizers, fans, etc)
  - environmental control operation
  - maintenance activities
- “Breakeven” Cost For Higher Quality Coal (\$1/MBtu reference)
  - med quality: \$1.40/MBtu
  - high quality: \$1.68/MBtu

### 3. Non-Fuel Operating Costs: Least Cost Coal Not Least Production Cost



## 4. Operating Factors In Risk Assessment As Predicted By Performance Model



# We Submit

- Vandivier addresses best way to provide a given coal composition
  - the user must specify coal composition to be provided
  - SO<sub>2</sub> as cited defaults to coal sulfur only
  - not a plant performance model
- Specifying coal composition does not predict generator performance – need process model
- Proposed Concept:
  - Don't need to know preferred coal composition – just what operator wants
  - Evaluates "risk" of each coal to weigh against cost